CLAIMS

1. A non-contact support platform for supporting without contact a stationary or traveling object by air-cushion induced forces, the platform comprising:

at least one of two substantially opposite support surfaces, each support surface comprising at least one of a plurality of basic cells each having at least one of a plurality of pressure outlets and at least one of a plurality of air-evacuation channels at least one of a plurality of outlets, and one of a plurality of air-evacuation channels, each of the pressure outlets fluidically connected through a pressure flow restrictor to a high-pressure reservoir, the pressure outlets providing pressurized air for generating pressure induced forces, maintaining an air-cushion between the object and the support surface, the pressure flow restrictor characteristically exhibiting fluidic return spring behavior; each of said at least one of a plurality of air-evacuation channels having an inlet and outlet, the inlet kept at an ambient pressure or lower, under vacuum condition, for locally discharging mass flow, thus obtaining uniform support and local nature response.

2. The platform as claimed in Claim 1, wherein the pressure flow restrictor comprises a conduit, having an inlet and outlet, provided with two opposite sets of fins mounted on the inside of the conduit, each two fins of same set and a portion of the conduit internal wall between them defining a cavity and the fin of the opposite set positioned opposite said cavity, so that when fluid flows through the conduit substantially stationary vortices are formed in the cavities said vortex existing at least temporarily during the flow thus forming an aerodynamic blockage allowing a central core-flow between the vortices and the tips of the opposite set of fins and suppressing the flow in a one-dimensional manner, thus limiting mass flow rate and maintaining a substantial pressure drop within the conduit.

3. The platform as claimed in Claim 1, wherein said at least one of a plurality of air-evacuation channels includes an evacuation flow restrictor.

4. The platform as claimed in Claim 3, wherein the evacuation flow restrictor comprises a conduit, having an inlet and outlet, provided with two opposite sets of fins mounted on the inside of the conduit, each two fins of same set and a portion of the conduit internal wall between them defining a cavity and the fin of the opposite set positioned opposite said cavity, so that when fluid flows through the conduit substantially stationary vortices are formed in the cavities said vortex existing at least temporarily during the flow thus forming an aerodynamic blockage allowing a central core-flow between the vortices and the tips of

the opposite set of fins and suppressing the flow in a one-dimensional manner, thus limiting mass flow rate and maintaining a substantial pressure drop within the conduit.

5. The platform as claimed in Claim 1, wherein the evacuation channels are fluidically connected to a vacuum reservoir.

6. The platform as claimed in Claim 5, wherein the vacuum flow restrictor has significantly lower aerodynamic resistance than the pressure flow restrictor.

7. The platform as claimed in Claim 6, wherein the vacuum flow restrictors are designed so as to lower the vacuum level to a value in the range of 70%-90% of the vacuum of the vacuum reservoir.

8. The platform as claimed in Claim 7, wherein the absolute value of pressure supply to the platform is larger by a factor of 1.2.-3 with respect to the absolute value of vacuum supply to the platform.

9. The platform as claimed in Claim 1, wherein the support surface comprises at least one of a plurality of planar surfaces.

10. The platform as claimed in Claim 9, wherein the support surface is flat.

11. The platform as claimed in Claim 9, wherein the support surface is provided with grooves.

12. The platform as claimed in Claim 9, wherein the support surface is cylindrically shaped.

13. The platform as claimed in Claim 1, wherein the support surface is substantially rectangular.

14. The platform as claimed in Claim 1, wherein the support surface is substantially circular.

15. The platform as claimed in Claim 1, wherein the support surface is constructed from plates in a layered formation.

16. The platform as claimed in Claim 15, wherein at least one of the plates contains a plurality of voids constructing the flow restrictors and inter-layer passages for the air-evacuation channels and for pressure or vacuum supply.

17. The platform as claimed in Claim 15, wherein the pressure reservoir is in the form of an Integral manifold within the layered-formation.

18. The platform as claimed in Claim 17, wherein the evacuation channels are fluidically connected to a vacuum reservoir and the vacuum reservoir is in the form of an Integral manifold within the layered-formation, constituting a double-manifold structure.

19. The platform as claimed in Claim 1, wherein said at least one of a plurality of basic cells is provided in a repeated arrangement in order to provide local balance.

20. The platform as claimed in Claim 19, wherein the basic cell is provided in a one-dimensional repeated arrangement.

21. The platform as claimed in Claim 19, wherein the basic cell is provided in a two-dimensional repeated arrangement.

22. The platform as claimed in Claim 1, wherein the pressure flow restrictors are designed so as to reduce the pressure supplied by the pressure reservoir to a value in the range of 30%-70% of the pressure of the pressure reservoir, to be introduced through the pressure outlets to the air-cushion.

23. The platform as claimed in Claim 1, wherein at least one of a plurality of through-openings is provided in the support surface, for allowing access to the object for handling or processing.

24. The platform as claimed in Claim 1, wherein the support surface is segmented into several segments, separated by spaces.

25. The platform as claimed in Claim 1, wherein the evacuation channels are fluidically connected to a vacuum reservoir, and wherein pressure level in the pressure reservoir or vacuum reservoir is regulated to adjust globally levitation gap of the object over the support surface.

26. The platform as claimed in Claim 1, wherein the evacuation channels are fluidically connected to a vacuum reservoir, and wherein pressure level in the pressure reservoir or vacuum reservoir is regulated in at least one selected separated zone of the pressure reservoir or vacuum reservoir, in order to locally adjust t levitation gap of the object over the support surface.

27. The platform as claimed in Claim 1, wherein the evacuation channels are fluidically connected to a vacuum reservoir and wherein along a line of selected separated zones of

the pressure reservoir the pressure is individually regulated, in order to flatten the object over the support surface along that line.

28. The platform as claimed in Claim 27, wherein the along the line selected separated zones parallelism is maintained with respect to an independent reference.

29. The platform as claimed in Claim 26, wherein the selected separated zones are located at edges of the support surface to suppress edge effects.

30. The platform as claimed in Claim 1, wherein resolution of basic cells at edges of the support surface is higher with respect to inner zones of the support surface, in order to minimize degrading edge effects of the air-cushion.

31. The platform as claimed in Claim 1, wherein the basic cell comprises at least one of a plurality of evacuation grooves, serving as an air-evacuation channel.

32. The platform as claimed in Claim 31, wherein the basic cell comprises at least one of a plurality of evacuation vents, serving as an air-evacuation channel.

33. The platform as claimed in Claim 1, wherein the basic cell comprises at least one of a plurality of evacuation vents, serving as an air-evacuation channel.

34. The platform as claimed in Claim 1, wherein pressure outlets and evacuation channels are arranged linearly, pressure outlets aligned in lines and evacuation channels aligned in lines.

35. The platform as claimed in Claim 1, wherein said at least one of two substantially opposing support surfaces is oriented so that the object is to be supported below it.

36. The platform as claimed in Claim 1, wherein the platform is adapted to be supported or conveyed over the object, which is stationary.

37. The platform as claimed in Claim 36, wherein the object is a carriage and the support surface is an elongated track.

38. The platform as claimed in Claim 37, wherein the track is provided with rails on opposing sides of the track to limit the motion of the object to a predetermined path over the track.

39. The platform as claimed in Claim 38, wherein the rails comprise each a platform as claimed in Claim 1, for eliminating or greatly reducing friction forces.

40. The platform as claimed in Claim 1, wherein the object is a flat track and the support surface is incorporated in a carriage.

41. The platform as claimed in Claim 40, wherein the track is provided with rails on opposing sides of the track to limit the motion of the carriage to a predetermined path over the track.

42. The platform as claimed in Claim 41, wherein the rails comprise each a platform as claimed in Claim 1.

43. The platform as claimed in Claim 1, wherein the ratio between the number of pressure outlets and evacuation channels is in the range of 3-16.

44. The platform as claimed in Claim 1, wherein gripping means are provided to be coupled to the object for holding or moving the object over the support surface.

45. The platform as claimed in Claim 44, wherein the gripping means comprise a gripper unit, which itself is supported with no contact by a support surface such as the one claimed in Claim 1.

46. The platform as claimed in Claim 45, wherein the gripping means comprise a gripper unit, which itself is supported with no contact by the support surface.

47. The platform as claimed in Claim 44, wherein the gripping means is coupled to the object and used to convey it over the support surface sideways.

48. The platform as claimed in Claim 47, wherein gripping means is coupled to the object and used to convey it over the support surface in a linear motion.

49. The platform as claimed in Claim 47, wherein gripping means is coupled to the object and used to convey it over the support surface in a rotational motion.

50. The platform as claimed in Claimed in Claim 44, wherein the gripping means is coupled to the support surface and the support surface is transportable.

51. The platform as claimed in Claim 1, wherein the platform is vertically oriented.

52. The platform as claimed in Claim 1, wherein the air-evacuation channels allow air to be passively discharged into ambient atmosphere.

53. The platform as claimed in Claim 52, wherein more flow restrictors are provided for each basic cell in order to support a heavier object and vice versa.

54. The platform as claimed in claim 52 wherein the evacuation channels are placed closer to pressure outlets for supporting a very light object.

55. The platform as claimed in Claim 54, wherein the higher the supply pressure is provided to the pressure reservoir the smaller the risk of contact between the object and the support surface.

56. The platform as claimed in Claim 1 designed to support an object which substantially covers the support surface, wherein the each of the air-evacuation channels is fluidically connected to a vacuum reservoir, thus generating vacuum-induced forces on the object, facilitating unilateral gripping of the object without contact by both the pressure induced forces and the vacuum induced forces, which act in opposite directions, where aerodynamic stiffness of the air-cushion is augmented by vacuum-preloading.

57. The platform as claimed in Claim 1 designed to support an object substantially is smaller than the support surface, wherein the each of the air-evacuation channels is fluidically connected to a vacuum reservoir through a flow restrictor, thus generating vacuum-induced forces on the object, facilitating unilateral gripping of the object without contact by both the pressure induced forces and the vacuum induced forces, which act in opposite directions, where aerodynamic stiffness of the air-cushion is augmented by vacuum-preloading.

58. The platform as claimed in Claim 1, wherein said at least one of two substantially opposite support surfaces comprise only one support surface, and opposite it a passive surface is provided so that the object may be pressed against the passive surface without contact by aerodynamically induced forces generated by the support surface.

59. The platform as claimed in Claim 58, wherein the passive surface is adapted to be laterally moved.

60. The platform as claimed in Claim 59, wherein the passive surface is a rotatable cylinder, that can be used as a driving unit to move the object by enhanced friction forces.

61. The platform as claimed in Claim 59, wherein the passive surface is a vacuum table.

62. A dual-sided non-contact support platform for supporting without contact an object by air-cushion induced forces, the platform comprising:

two substantially opposite support surfaces, each support surface comprising at least one of a plurality of basic cells having at least one of a plurality of pressure

outlets and at least one of a plurality of air-evacuation channels at least one of a plurality of outlets, and one of a plurality of air-evacuation channels, each of the pressure outlets fluidically connected through a pressure flow restrictor to a high-pressure reservoir, the pressure outlets providing pressurized air for generating pressure induced forces, maintaining an air-cushion between the object and the support surface, the pressure flow restrictor characteristically exhibiting fluidic return spring behavior; each of said at least one of a plurality of air-evacuation channels having an inlet and outlet, the inlet kept at an ambient pressure or lower, under vacuum condition, for locally discharging mass flow, thus obtaining uniform support and local nature response.

63. The platform as claimed in Claim 62, wherein each of the air-evacuation channels is connected to a vacuum reservoir.

64. The platform as claimed in Claim 63, wherein each of the air-evacuation channels is connected to a vacuum reservoir through a vacuum flow restrictor, the vacuum flow restrictor characteristically exhibiting fluidic return spring behavior.

65. The platform as claimed in Claim 62, wherein the two substantially opposite support surfaces are substantially symmetrical.

66. The platform as claimed in Claim 62, wherein a gap between the two substantially opposite support surfaces is determined to be at least the width of anticipated object to be supported within plus twice the desired air-cushion gap.

67. platform as claimed in Claim 66, wherein a preload mechanical spring is provided to adjust the gap between the two substantially opposite support surfaces in a parallel and self adaptive manner, and limit the forces induced on the two substantially opposite support surfaces to below a predetermined threshold.

68. The platform asclaimed in Claim 62, wherein pressure supply or vacuum to one of the two substantially opposite support surfaces is different from the pressure supply or vacuum supply to the second of the two substantially opposite support surfaces, so that the levitation of the object between the two substantially opposite support surfaces may be adjusted to any desired gap in between the surfaces.

69. A system for conveying without contact a substantially flat object, the system comprising:

at least one of two substantially opposite support surfaces, each support surface comprising at least one of a plurality of basic cells having at least one of a plurality of pressure outlets and at least one of a plurality of air-evacuation channels at least one of a plurality of outlets, and one of a plurality of air-evacuation channels, each of the pressure outlets fluidically connected through a pressure flow restrictor to a high-pressure reservoir, the pressure outlets providing pressurized air for generating pressure induced forces, maintaining an air-cushion between the object and the support surface, the pressure flow restrictor characteristically exhibiting fluidic return spring behavior; each of said at least one of a plurality of air-evacuation channels having an inlet and outlet, the inlet kept at an ambient pressure or lower, under vacuum condition, for locally discharging mass flow, thus obtaining uniform support and local nature response;

driving mechanism for driving the object over said at least one of two substantially opposite support surfaces;

handling means for handling the object during loading or unloading of the object onto said at least one of two substantially opposite support surfaces;

sensing means for sensing properties selected from the group of properties including: position, orientation, proximity and velocity of the object; and

controller for controlling the position, orientation and traveling velocity of the object over said at least one of two substantially opposite support surfaces and communicate with a process line adjacent the system.

70. The system as claimed in Claim 69, wherein loading and unloading zones are provided.

71. The system as claimed in Claim 69, comprising several one-sided types of said at least one of two substantially opposite support surfaces.

72. The system as claimed in Claim 71, wherein one of the several one-sided types of said at least one of two substantially opposite support surfaces comprises a PV support surface for providing flattening of the object, where at central zone of that PV support surface a processing on the object is conducted.

73. The system as claimed in Claim 72, wherein the PV support surface is provided with a relaxation zone on edges of the PV support surface having a relaxation length of about 5-15 lengths of basic cells.

74. The system as claimed in Claim 69, further comprising at least one of a plurality of dual-sided type of said at least one of two substantially opposite support surfaces.

75. The system as claimed in Claim 74, the dual-sided type of said at least one of two substantially opposite support surfaces comprising PP-type dual-sided support surfaces for high flattening performance.

76. The system as claimed in Claim 74, the dual-sided type of said at least one of two substantially opposite support surfaces comprising PV-type dual-sided support surfaces for high flattening performance.